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ABSTRACT

This study was designed to determine the effect of high school physics, the frequency of high school physics laboratory use, and high school mathematics background on the success of students taking first semester physics. Data were obtained from undergraduates (N=248) at Mississippi State University. The final letter grade in the first semester of freshman physics was used as the measure of physics success. Based on the findings from the 248 participating students, characteristics identified as indicators of success in freshman physics were: (1) high school physics background; (2) a strong background in mathematics including geometry, advanced math and calculus; and (3) laboratory experience in the high school physics background. (ML)

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Factors Contributing to Freshman Physics Achievement

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Factors Contributing to Freshman Physics Achievement

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Increased emphasis on the physical sciences has been reflected by increased requirements in the physical sciences for high school graduation (Mississippi, 1983). In a study assessing factors that contributed to success in statewide physics competition for high school seniors, Harpole (1985) found that calculus and small group laboratory experiences increased physics achievement.

The purpose of the present study was to determine the effect of high school physics, the frequency of high school physics labs, and high school mathematics background on success of students taking first semester freshman physics at Mississippi State University.

The population for this study was the 248 students enrolling in PH 1113 during the summer of 1985, fall of 1985, and spring of 1986. A permission form was obtained and data was gathered from each student during the first week of each school term. Data was gathered by a short questionnaire that explained the purpose of the study and asked for the following information: (1) if the student had taken high school physics, (2) if a high school physics course was taken, were labs scheduled "regularly" or "infrequently or never," and (3) the specific high school mathematics courses taken. The final letter grade in the first semester of freshman physics was used as the measure of physics success.

Table 1 presents a comparison of the final letter grades obtained in first semester freshman physics when students had taken high school physics and when students had not taken a course in high school physics. A significant (.000) X^2 value of 46.23 was obtained for the comparison between the two groups when the number of students in each group receiving

a letter grade of A, B, C, D, and F was compared. Students that had taken a high school physics course made a higher percentage of A, B, and C grades while students that had not had a high school physics course made a higher percentage of D and F grades.

Insert Table 1

Table 2 provides a list of the X^2 values for the comparison of letter grades between students that had taken a specific high school mathematics course and students that had not taken that course. A significant X^2 value was not obtained between the two groups for the following mathematics courses: Algebra I, Algebra II, and trigonometry. Geometry, advanced math, calculus and the total number of math courses taken all produced significant (.000) differences with students that had taken the respective mathematics courses in high school receiving higher letter grades in college physics.

Insert Table 2

Table 3 presents data for high school students that had taken physics with a regularly scheduled laboratory versus those students that had taken high school physics where labs were scheduled infrequently or never. A X^2 value of 8.42 significant at the .07 level was found for this comparison. Students that had taken a high school physics course where labs were scheduled regularly tended to make higher letter grades in college physics. Especially notable was the number of students in each group failing the course. While 22.7% of the non-lab students received a grade of D or F, only 5.7% of the students with regularly scheduled high school labs received a grade of D or F. This finding supports the finding of

Harpole (1985) that high school laboratory experience is important to physics success.

Insert Table 3

To further explore the effect of the variables studied on college physics grades, a multiple regression analysis was used to determine what combination of variables would best predict physics grades. The .05 alpha level was employed for determining the entry of variables into the regression equation. Variables, in a stepwise manner, were allowed to enter the regression as long as they contributed a minimum of 1% to the amount of variance explained by the analysis.

The best predictor of letter grades in college physics was high school physics which explained 17.3% of the variance. The total number of high school math courses taken explained 7.3% and taking an advanced math course explained an additional 1.4% of the variance. The last factor to explain a minimum of 1% of the total variance was frequent high school labs in physics. This variable accounted for 1.1% of the variance. The total predictor set explained 27.1% of the variance in grades in freshman physics classes at Mississippi State University.

Insert Table 4

Based on the findings from the 248 students studied in this study, the characteristics of a successful student in PH 1113 would be: (1) a high school physics background, (2) a strong background in mathematics including geometry, advanced math and calculus, and (3) laboratory experience in the high school physics background.

Table 1

Chi Square Contingency Table for Students Taking and Not Taking High School Physics by Success in College Freshman Physics

Grade	Physics (N = 119)		No Physics (N = 129)	
	N	%	N	%
A	28	23.5	7	5.4
B	32	26.9	19	19.7
C	41	34.5	34	26.4
D	10	8.4	35	27.1
F	8	6.7	34	26.4

Obtained X^2 = 46.23 (4 df) sign. .000

Table 2

Chi Square Values for Students Taking and Not Taking High School Mathematics Courses and Success in College Freshman Physics

Course	X^2 Value	df	Significance
Algebra I	2.504	4	.644
Algebra II	7.470	4	.113
Trigonometry	5.839	4	.211
Geometry	21.316	4	.000
Advanced Math	36.359	4	.000
Calculus	19.917	4	.000
Total Math	54.380	20	.000

Table 3

Chi Square Table for High School Physics Students Having and Not Having Regularly Scheduled Labs and Success in College Freshman Physics

Grade	Laboratory (N = 53) N	%	No Laboratory (N = 66) N	%
A	14	26.4	14	21.2
B	15	28.3	17	25.8
C	21	39.6	20	30.3
D	3	5.7	7	10.6
F	0	0	8	12.1

Obtained $X^2 = 8.429$ (4 df) sign. .07

Table 4

F Values and % of Variance Explained by Each Predictor Variable of Success in College Freshman Physics

Variable	F Ratio	Significance	R^2
H.S. Physics	51.62	.001	.173*
Total Math	23.75	.001	.073*
Adv. Math	4.73	.05	.014*
Physics Lab	3.67	.10	.011*
Calculus	2.32	NS	.007
Trigonometry	1.93	NS	.002
Algebra I	.08	NS	.000
Algebra II	.09	NS	.000

*Explains 1% or more of variance in freshman college physics grades.

References

Harpole, S. & Gifford, V. (1985). Factors contributing to achievement in statewide physics competition. Program and Proceedings of the Fourteenth Annual Meeting of the Mid-South Educational Research Association (p. 79).

Mississippi, State of. High School Units (Grades 9-12) required for admission to public universities in Mississippi (Policy adoption by The Board of Trustees of State Institutions of Higher Learning, State of Mississippi), July 15, 1982.